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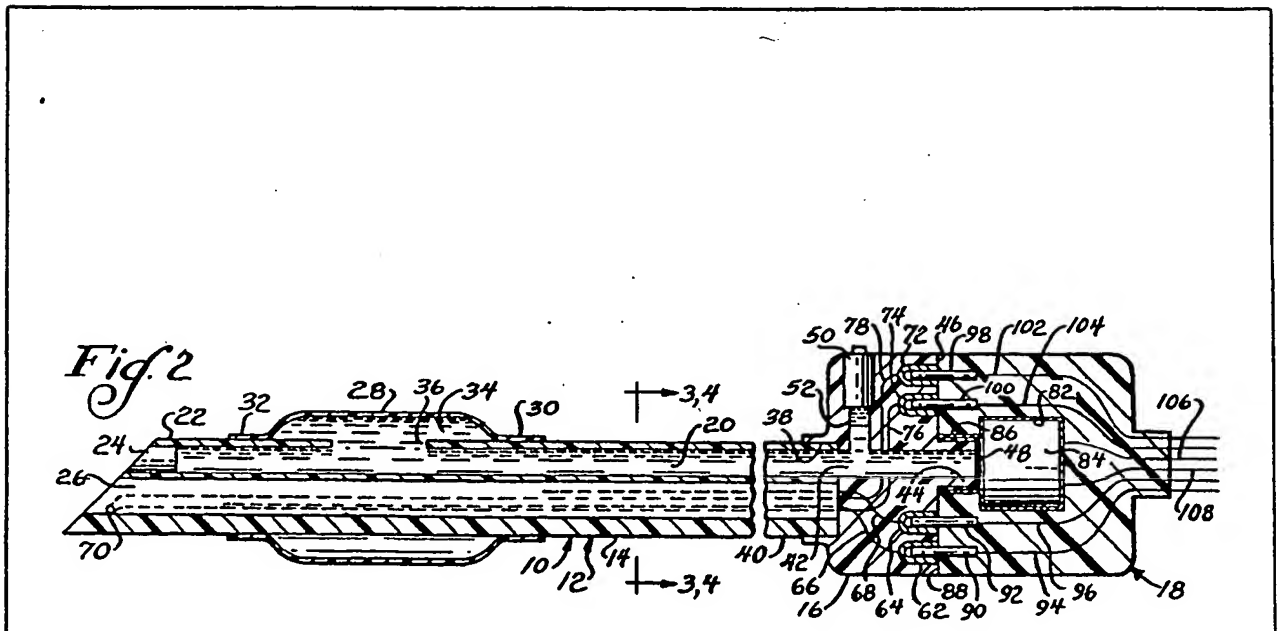
(54) Oesophageal probe

(57) An oesophageal probe comprises a shaft assembly including a shaft containing a sound conducting medium extending from the distal end of the shaft assembly to its proximal end and a vibration detection device adjacent the proximal portion of the medium for detecting sounds transmitted through the medium.



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SPECIFICATION

Oesophageal probe

Various forms of oesophageal probe have been proposed for insertion into the oesophagus of a patient to monitor body functions of the patient. However, in the past either the entire probe has been regarded as disposable and is therefore costly, or the entire probe has been regarded as non-disposable, with the resulting inconvenience involved by cleaning and sterilization of the probe between uses on separate patients.

The invention provides an oesophageal probe comprising a shaft assembly including a shaft containing a sound conducting medium, which extends from the distal end of the shaft assembly to its proximal end, a first connector attached to the proximal end of the shaft, and a second connector releasably attached to the first connector and containing a vibration detection device adjacent the proximal portion of the medium to detect sounds transmitted by said medium.

Since the vibration detection device is located in the second connector rather than the shaft, this permits use of a shaft of reduced diameter for insertion into the patient. Furthermore the shaft assembly may be discarded after use on a patient, after which the second connector may be attached to another shaft assembly for use on a subsequent patient.

The second connector including the vibration detection device may therefore be utilized with a plurality of shaft assemblies in different patients to avoid discarding the relatively expensive vibration detection device while permitting discarding of the disposable shaft assembly.

One embodiment of oesophageal probe according to the invention is illustrated in the drawings, in which:–

Figure 1 is a fragmentary elevational view of the probe,

Figure 2 is a longitudinal view in section of the probe shown in Fig. 1,

Figures 3 and 4 are sections taken along the line 3,4–3,4 in Fig. 2 and showing leads extending through channels in the probe before and after closing of the grooves, and

Figure 5 is a section taken along the line 5–5 in Fig. 1.

The oesophageal probe 10 shown in Figs. 1 and 2 includes a shaft assembly 12 comprising an elongated shaft 14, and a connector 16. As shown, the shaft 14 has an inflation lumen 20 closed at the distal end 22 of the shaft by a plug 24 and another lumen 26. The shaft assembly 12 also has an inflatable balloon 28 of elastic material having opposed end portions 30 and 32 which are secured to the outer surface of the shaft 14 at circumferential zones, so that the balloon 28 defines a cavity 34 communicating with the inflation lumen 20 through an opening 36 in the wall of the shaft 14.

The connector 16 has a recess 38 to receive the proximal end 40 of the shaft 14 and is secured to the shaft 14 by suitable means, such as adhesive. The connector 16 has a bore 42 in register with the inflation lumen 20 and a tubular extension 44 which extends from the proximal face 46 of the connector 16. The connector 16 includes a membrane 48 of elastic and flexible material, such as rubber, connected to the extension 44 and extending across the bore 42 at the proximal end of the extension 44 in order to close the proximal end of the inflation lumen 20. The connector 16 also includes a valve 50 of known type communicating with the inflation lumen 20 through a side channel 52. When a syringe is attached to the valve 50, the valve 50 permits passage of liquid from the syringe through the valve 50 in order to fill the inflation lumen 20 and the cavity 34 with the liquid and inflate the balloon 20. The liquid in the inflation lumen 20 may also be removed through the valve 50 by use of the syringe.

The shaft assembly 12 has spaced conductive ECG electrodes 54 and 56 extending circumferentially around the balloon 28 on the outer surface of the balloon, the electrode 54 having a conductive lead extending from the electrode 54 to the proximal end of the balloon 28, and the distal electrode 56 having an associated lead 60 of conductive material extending from the electrode 56 to the distal end of the balloon 28. The electrodes 54 and 56 and leads 58 and 60 may be made of a metallic paint placed on the outer surface of the balloon 28. The connector 16 has a pair of recesses in its proximal face 46 which accommodate sockets 60 and 64 of conductive material, such as metal. A conductive lead 66 connected to the socket 62 extends through the connector 16 and the wall of the shaft 14 to the distal end of the lead 60 in order to establish electrical connection between the socket 62 and the electrode 56. Another conductive lead 68 connected to the socket 64 extends through the connector 16 and the wall of the shaft 14 to the proximal end of the lead 58 in order to establish electrical connection between the electrode 54 and the socket 64.

A temperature sensor 70 is disposed in the lumen 26 adjacent the distal end 22 of the shaft 14. The connector 16 has another pair of recesses in its proximal face 46 which accommodate a pair of sockets 72 and 74 of conductive material, such as metal, which are connected by respective conductive leads 76 and 78 to the temperature sensor 70. As shown in Fig. 3, the shaft 14 has a plurality of grooves 80 extending longitudinally through the shaft in which the leads 66, 68, 76 and 78 are placed, after which the grooves 80 are closed by adhesive, as shown

in Fig. 4, or by heat sealing. The shaft 14 may be made of plastics material such as polyvinyl chloride. The connector 16 and another connector 18 may also be made of plastics material, such as polyvinyl chloride.

The connector 18 has a central cavity 82 and a vibration detection device 84, such as a microphone or hydrophone, hereinafter referred to as a microphone. The connector 18 also has a recess 86, extending from the microphone 84 to the distal face 88 of the connector 18, which receives the tubular extension 44. The connector 18 has a pair of conductive pins 90 and 92 extending from its distal face 88 of the second connector 18 for insertion into the sockets 62 and 64 respectively, and a pair of conductive leads 94 and 96, extending from the pins 90 and 92 respectively, through the connector 18 to its proximal end and another pair of conductive pins 98 and 100 extending from its distal face 88 for insertion into the sockets 72 and 74 respectively, and a pair of conductive leads 102 and 104, extending from the pins 98 and 100 respectively, through the connector 18 to its proximal end. The connector 18 also has a pair of conductive leads 106 and 108 extending from the microphone 84 through the connector 18 to its proximal end of the second connector 18. The proximal ends of the leads 94, 96, 102, 104, 106 and 108 may be formed into a cable connected to the proximal end of the connector 18.

When the connector 18 is attached to the connector 16, the pins 90, 92, 98 and 100 are frictionally received in the sockets 62, 64, 72 and 74 respectively, in order to establish electrical contact between the pins and sockets and detachably attach the second connector 18 to the first connector 16. When the connectors are so attached, the pins and sockets establish electrical connection between the leads 94 and the electrode 56 through the leads 66 and 60, between the lead 96 and the electrode 54 through the leads 68 and 58, and between the leads 102 and 104 and the temperature sensor 70 through the leads 76 and 78. Also, as shown in Fig. 2, when the connector 18 is attached to the connector 16, the membrane 48 which closes the proximal end of the inflation lumen 20 is located adjacent the microphone 84. Thus, sounds occurring adjacent the balloon 28 are transmitted by the liquid in the cavity 34 and the inflation lumen 20 to the membrane 48 and the microphone 84 to enable the microphone 84 to detect sounds when the probe is located in the patient's body.

In use, the shaft 14 of the probe 10 is inserted into the oesophagus of a patient with the balloon in an uninflated condition. A syringe is then attached to the valve 50 and liquid is pumped from the syringe through the valve 50 into the inflation lumen 20 in order to fill the inflation lumen 20 and the cavity 34 and inflate the balloon 28. The leads 106 and 108 associated with the microphone 84 may be attached to electrical equipment for monitoring sounds transmitted through the sound conducting medium constituted by the liquid in the cavity 34 and the inflation lumen 20 in order to monitor heart and lung sounds occurring adjacent the inflatable balloon 28. Also, the leads 94 and 96, which are electrically connected to the electrodes 54 and 56, may be connected to ECG electrical monitoring equipment. Similarly, the leads 102 and 104, which are electrically connected to the temperature sensor 70, may be connected to electrical equipment to indicate the temperature in the patient's body.

After use of the probe 10 in the patient's body, the shaft 14 may be removed from the oesophagus, and the connector 16 of the shaft assembly 12 may be removed from the connector 18, after which the used shaft assembly 12 may be discarded. The connector 18 may then be attached to another shaft assembly 12 of the same type in order to use the oesophageal probe 10 on another patient. The shaft assembly 12 is thus disposable, while the relatively expensive microphone 84 in the connector 18 may be utililzed with a number of shaft assemblies 12 on different patients. Also, placement of the microphone 84 in the connector 18 permits use of a shaft 14 of reduced external dimensions for insertion into the patient's body as compared to a shaft in which the microphone is located in the shaft itself.

CLAIMS

1. An oesophageal probe, comprising a shaft assembly including a shaft containing a sound conducting medium, which extends from the distal end of the shaft assembly to its proximal end, a first connector attached to the proximal end of the shaft, and a second connector releasably attached to the first connector and containing a vibration detection device adjacent the proximal portion of the medium to detect sounds transmitted by said medium.

2. A probe according to claim 1, wherein the vibration detection device is a microphone.

3. A probe according to claim 1, wherein the sound conducting medium is constituted by liquid accommodated in a lumen extending from the distal end of the shaft to the proximal end of the first connector.

4. A probe according to claim 3, which includes a flexible membrane covering the proximal end of the lumen and in which the sound detection device is located adjacent the membrane.

5. A probe according to claim 1, which includes a pair of electrodes at the distal end of the shaft assembly, contacts establishing electrical connection between the two connec-

tors, and conductors electrically connecting the electrodes to the contacts.

6. A probe according to claim 5, wherein the contacts are constituted by conductive sockets in one of the connectors and cooperating conductive pins extending from the other connector which are received in the sockets when the connectors are attached together.

7. A probe according to claim 3 or claim 4, which includes an inflatable balloon at the distal end of the shaft assembly which communicates with the lumen.

8. A probe according to claim 5 and claim 7, in which the electrodes are on the outer surface of the balloon.

9. A probe according to claim 7, which includes a valve on the shaft assembly which communicates with the lumen to permit passage of liquid through the valve to inflate the balloon.

10. A probe according to claim 4, wherein the first connector includes a tubular extension extending from its proximal end of the first connector and constituting the proximal end of the inflation lumen, and in which the second connector includes a recess to receive the tubular extension when the second connector is attached to the first connector, the vibration detection device being located adjacent the inner end of the recess.

11. A probe according to claim 1, which includes a temperature sensor in the distal end of the shaft which is electrically connected to contacts establishing electrical connection between the two connectors.

12. An oesophageal probe according to claim 1, substantially as described herein with reference to the accompanying drawings.

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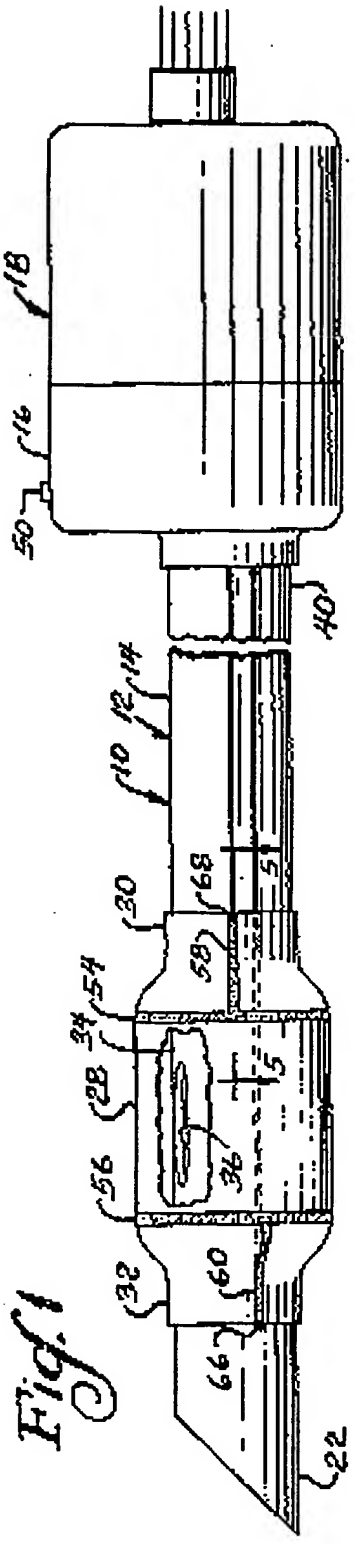

Fig. 1

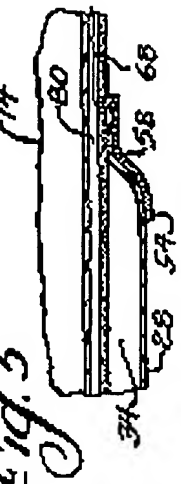

Fig. 5

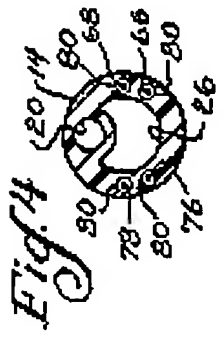

Fig. 4

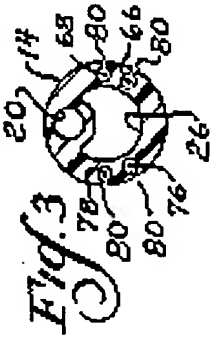

Fig. 3

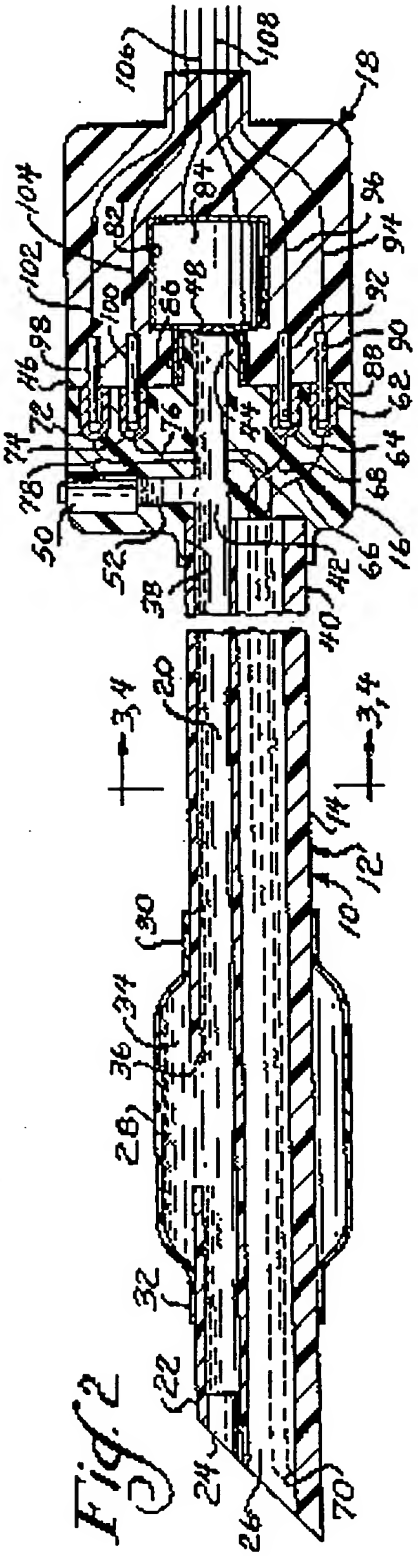

Fig. 2